Amendment to the Drawings

Please accept the enclosed replacement drawing sheets 1-10, 15, and 17 titled "New Sheet."

Comments: Specification

The specification was amended to clarify the claim of priority.

Numerals 211A and 211B were changed to 204A and 204B, respectively, to comply with numerals shown in the figures, as required by the Examiner.

Minor editorial corrections were made to the specification.

Comments Claims

Claim 5 was amended to better distinguish the claimed invention over the prior art. In particular, Claim 5 now recites a receiver system for receiving a transmitted multicarrier signal configured to map each of a plurality of data symbols to a pulse in a pulse sequence characterized by a superposition of carrier signals. The combiner now recites combining the received multicarrier signals for producing a data-modulated pulse sequence, and the time-domain receiver recites producing data estimates from the data-modulated pulse sequence. Minor editorial changes were also made to Claim 5 and independent Claims 7 and 8, including changes to provide terms with a proper antecedent basis.

Claim 16 was amended to better distinguish the claimed invention over the prior art. In particular, Claim 16 now specifically recites the multicarrier signal being configured to map each of a plurality of data symbols to a pulse in a pulse sequence characterized by a superposition of carrier signals. Accordingly, in the step of providing for combining, the at least one time-domain signal is characterized by the plurality of data symbols modulated on a pulse sequence. Minor editorial changes were also made, including changes to provide terms with a proper antecedent basis.

Claims 49-56, which are dependent on Claim 16, were amended in order to comply with terminology used in the amended Claim 16. Minor editorial changes were also made.

Claim 18 was amended to better distinguish the claimed invention over the prior art. In particular, Claim 18 now recites a multi phase-space detector capable of detecting a plurality of information signals modulated on a plurality of signal phase-spaces that map each of the plurality of information signals to a pulse in a pulse sequence characterized by a superposition of carrier signals. Accordingly, Claim 18 also recites a combining circuit capable of combining the plurality of frequency components to generate at least one pulse sequence modulated with the plurality of information signals.

Claims 60, 61, and 64, which are dependent on Claim 18, were amended in order to comply with terminology used in the amended Claim 18. Minor editorial changes were also made.

The specification and figures clearly show a multicarrier signal configured to map each of a plurality of data symbols to a pulse in a pulse sequence characterized by a superposition of carrier signals. For example, FIG. 5A shows amplitudes of carrier signals and FIG. 5B shows a resulting direct-sequence signal of pulse waveforms produced by a superposition of the carrier signals represented in FIG. 5A. FIG. 19 depicts an arrangement of individual pulses in pulse sequence generated from a superposition of carriers. The pulses (i.e., short impulses) provide orthogonality in the time domain (page 6, lines 2-4).

Comments: Drawings

The drawings were amended to address the objections raised in the Examination Report.

In particular, the drawings were objected to because elements in Figures 1, 2, 3H, 10, 11A, 13, 14A-E, 15, 17A-B, and 28A contained elements requiring descriptive labels. The replacement drawing sheets submitted herewith correct these deficiencies.

The drawings were also objected because numeric labels 123, 125, 127, 129, 130, 133, 135, and 137 mentioned in the specification with reference to Figure 3A did not appear in Figure 3A. The amended Figure 3A submitted in replacement drawing sheet 2 includes the numeric labels 123, 125, 127, 129, 130, 133, 135, and 137 mentioned in the specification.

The other objections to the drawings are noted. In particular, the element labeled "104" in Figure 6A was changed to "114" in the new drawing sheet 5. The element labeled "221" in Figure 13 was changed to "201" in the new drawing sheet 7. The elements labeled "210" in Figures 14B and 14C were changed to "201" in the new drawing sheet 8. The elements labeled "212A" and "212B" in Figure 14E were changed to "215A" and "215B" respectively in the new drawing sheet 9. Also, the element labeled "158" in Figure 15 was changed to "151" in the new drawing sheet 9.

Comments: Examination Report

Favorable reconsideration of this application as presently amended is respectfully requested.

Claims 5-8, 16, 18, and 49-64 are pending.

The indicated allowability of claims 5-8, 16, and 18 was withdrawn in view of newly cited references Piehler (US 5,940,196), Kondo (US 5,521,937), Raleigh (US 6,144,711), and Vanoli (US 5,712,716).

Claims 5, 6, 8, 16, 18, 49, and 54 were rejected under 35 U.S.C. 102(e) as being anticipated by Piehler (US 5,940,196).

These rejections are respectfully traversed with respect to the claims as currently presented and in view of the arguments presented as follows.

The claimed receiver system in the amended independent claim 5 (and thus, dependent claims 6-8) is novel in view of Piehler because;

1. The claimed receiver system is configured for receiving a transmitted multicarrier signal configured to map each of a plurality of data symbols to a pulse in a pulse sequence characterized by a superposition of carrier signals. Conversely, Piehler discloses merely redundantly modulated the same information on multiple carriers (i.e., wavelengths) without adjusting either the information or the carriers to produce a pulse sequence. Such a pulse sequence allows data symbols sharing the same carriers to be placed on different pulses, which are separable in time. This enables a time-domain receiver to be used without having to first obtain data symbol estimates from the individual carrier signals, as is typically done in the prior art (including Piehler). Furthermore, the mapping of data symbols to pulses allows the multiple data symbols to share the same frequencies and time interval without necessarily sacrificing bandwidth efficiency. Instead, the Piehler system

does not allow multiple data symbols to share the same frequency at the same time, and therefore, must sacrifice bandwidth efficiency (col. 2, lines 19-20).

2. The claimed receiver system recites a combiner capable of combining the multicarrier signals for producing a data-modulated pulse sequence. Conversely, Piehler describes removing information (the RF signal) from the carriers, followed by combining the information without the carriers (col. 6, lines 52-57). The combiner in the claimed receiver is substantially different than Piehler's combiner, because it combines data-modulated carriers to produce a data-modulated pulse sequence, whereas Piehler's combiner only combines information after it is removed from the carriers.

Piehler does not describe a multicarrier signal that maps each of a plurality of data symbols to a pulse in a pulse sequence, nor does Piehler describe a combiner that combines a multicarrier signal to produce a data-modulated pulse sequence. Therefore, Claims 5-8 should be considered novel over Piehler.

Rather, Piehler describes two different optical signals that carry the same RF information, resulting in a 3dB improvement in carrier to noise (col. 2, lines 31-35), since twice the power is now allocated to the information. This redundancy means that half of the channel's bandwidth efficiency is sacrificed in order to double the signal quality (col. 2, lines 19-20). A receiver phase aligns the received signals in order to correct for propagation time differences due to chromatic dispersion (col. 3, lines 1-9). The RF information is removed from each of the carriers by photodiodes 104 and 108, and then the RF information is combined (col. 6 lines 52-57).

The amended independent Claim 16 recites the multicarrier signal being configured to map each of a plurality of data symbols to a pulse in a pulse sequence characterized by a superposition of carrier signals. Furthermore, the amended independent Claim 16 recites providing for combining the multicarrier signal to produce at least one time-domain signal characterized by the plurality of data symbols modulated on a pulse sequence.

The claimed method of receiving a multicarrier signal recited in the amended independent claim 16 (and thus, in dependent claims 49-56) is novel in view of Piehler because of the same reasons stated with respect to Claim 5.

Similarly, the amended independent Claim 18 recites a multi phase-space detector capable of detecting a plurality of information signals modulated on a plurality of signal phase-spaces that map each of the plurality of information signals to a pulse in a pulse sequence characterized by a superposition of carrier signals. Claim 18 also recites a combining circuit capable of combining the plurality of frequency components to generate at least one pulse sequence modulated with the plurality of information signals.

Accordingly, the claimed method of receiving a multicarrier signal recited in the amended independent claim 18 (and thus, in dependent claims 57-64) is novel in view of Piehler because of the same reasons stated with respect to Claim 5.

Claims 16 and 49-54 were rejected under 35 U.S.C. 102(b) as being anticipated by Kondo (US 5,521,937).

The claimed method of receiving a multicarrier signal in the amended independent claim 16 (and thus, dependent claims 49-56) is novel in view of Kondo because;

1. The claimed method is configured for receiving a transmitted multicarrier signal configured to map each of a plurality of data symbols to a pulse in a pulse sequence characterized by a superposition of carrier signals. Conversely, Kondo discloses multiplying the same spread signal onto multiple carriers (col. 5, line 64- col. 6, line 11) without adjusting either the spread signal or the carriers to produce a pulse sequence. Such a pulse sequence allows data symbols sharing the same carriers to be placed on different pulses, which are separable in a time-domain receiver. This allows multiple data symbols to share the same frequencies and time interval without necessarily sacrificing bandwidth efficiency. Instead, the Kondo system does not allow multiple data symbols to share the same

frequency at the same time, and therefore, must sacrifice bandwidth efficiency (col. 2, lines 19-20).

2. The claimed receiver method recites combining the multicarrier signal for producing a data-modulated pulse sequence. Conversely, Kondo describes obtaining symbol estimates from the carriers, followed by combining the symbol estimates in a maximal ratio combiner (col. 6, lines 40-42). The combining step in the claimed method is substantially different than the combining described in Kondo, because it combines data-modulated carriers to produce a data-modulated pulse sequence, whereas Kondo's combiner only combines information after it is removed from the carriers.

Kondo does not describe a multicarrier signal that maps each of a plurality of data symbols to a pulse in a pulse sequence, nor does Kondo describe combining a multicarrier signal to produce a data-modulated pulse sequence. Therefore, Claims 16 and 49-56 should be considered novel over Kondo.

Rather, Kondo describes direct-sequence processing used to spread a data signal with a pseudo-noise (PN) signal (col. 5, lines 59-66). The resulting spread-data signal is multiplied by each of a plurality of carrier signals (col. 5, line 64- col. 6, line 11). Specifically, each carrier signal is multiplied with the same spread-data signal (col. 6, lines 17-21), which provides redundant transmissions across the carrier signals. A receiver performs despreading before frequency-domain processing (col. 6, lines 29-31). Since the received signal is despread before each frequency is processed, correlation over each carrier signal produces a data symbol estimate (col. 6, lines 31-36). The symbol estimates from all of the carrier signals are combined in a maximal ratio combiner (col. 6, lines 40-42).

Claims 18 and 57-64 were rejected under 35 U.S.C. 102(e) as being anticipated by Raleigh (US 6,144,711).

The claimed detector for receiving a multicarrier signal in the amended independent claim 18 (and thus, dependent claims 57-64) is novel in view of Raleigh because;

1. The claimed detector is configured for detecting a plurality of information signals modulated on a plurality of signal phase-spaces that map each of the plurality of information signals to a pulse in a pulse sequence characterized by a superposition of carrier signals. Conversely, Raleigh discloses transmitting data using multiple antennas without adjusting either the data or the carriers to produce a pulse sequence. Such a pulse sequence allows data symbols sharing the same carriers to be placed on different pulses, which are separable in a time-domain receiver. Instead, the Raleigh system employs spatial multiplexing (e.g., multiple-input, multiple-output) to enable multiple data symbols to share the same frequency at the same time, which requires a receiver antenna array (e.g., "Receive Antennas" shown in Fig. 12). Furthermore, Raleigh does not teach modulating each data symbol on more than one carrier, which is a prerequisite for producing a pulse sequence characterized by a superposition of carrier signals.
2. The claimed detector recites a combining circuit capable of combining the plurality of frequency components to generate at least one pulse sequence modulated with the plurality of information signals. Conversely, Raleigh describes a receiver spatial processor that creates substantially independent subchannels within each SOP (i.e., frequency) bin (col. 8, lines 34-63). Since Raleigh teaches combining only same-frequency components (i.e., with in each SOP bin), the receiver spatial processor is not capable of producing a pulse sequence from the combined signals, and certainly not a pulse sequence that is characterized by a superposition of carrier signals. Therefore, the combining circuit in the claimed invention is substantially different than the receiver spatial processor described in Raleigh, because it combines data-modulated carriers to produce a data-modulated pulse sequence.

Since Raleigh does not describe a multicarrier signal that maps each of a plurality of data symbols to a pulse in a pulse sequence, nor does Raleigh describe combining a

multicarrier signal to produce a data-modulated pulse sequence, the Claims 18 and 57-64 should be considered novel.

Claims 7 and 58 were rejected under 35 U.S.C. 103(a) as being unpatentable over Piehler in view of Vanoli (US 5,712,716).

Although Vanoli shows a filter bank, the combination of Piehler and Vanoli does not teach a multicarrier signal that maps each of a plurality of data symbols (or information signals) to a pulse in a pulse sequence characterized by a superposition of carrier signals. Furthermore, the combination of Piehler and Vanoli does not teach to combine a received multicarrier signal to produce an information-modulated pulse sequence. Since the combination of Piehler and Vanoli neither teaches nor suggests the desirability of producing a pulse sequence from a multicarrier signal, the independent claims 5, 16, and 18 should be viewed as non-obvious over the prior art. Consequently, Claims 7 and 58 should also be patentable under 35 U.S.C. 103(a).

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance, and favorable action is respectfully solicited. If the Examiner has any questions or concerns regarding the present response, the Examiner is invited to contact Steve Shattil at 303 554-9106.

Very respectfully,

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